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MARRIAGE OF TUBERCULOUS PERSONS.

A JUDICIAL DECISION ANNULING THE MARRIAGE OF A PERSON WHO CONCEALED THE FACT THAT HE WAS SUFFERING FROM TUBERCULOSIS.

The courts have held in a number of instances that the marriage of a person suffering from a venereal disease might be annulled at the instance of the other party to the marriage when the existence of the disease had been concealed. The Supreme Court of the State of New York, in *Sobol v. Sobol* (p. 3175 of this issue of the Public Health Reports) carries this legal principle one step farther.

The defendant (the husband) had been treated for tuberculosis and knew that he was suffering from the disease. He concealed this fact from his fiancée, and explained certain symptoms by saying that he was suffering from a cold. After the marriage his wife discovered the nature of his illness and brought suit to annul the marriage. No issue resulted from the union.

The court decided that, in view of the possible serious consequences of such a marriage to the wife, to the children if any should be born, and to the community, the marriage contract should be annulled. The legal basis of the decision was the fraud of the defendant in concealing and misrepresenting the condition of his health.

THE PREVENTION OF PELLAGRA.

A TEST OF DIET AMONG INSTITUTIONAL INMATES.

By JOSEPH GOLDBERGER, surgeon; C. H. WARING, assistant surgeon, and DAVID G. WILLETS, assistant epidemiologist, United States Public Health Service.

INTRODUCTION.

(By GOLDBERGER.)

In a paper published June 26, 1914, attention was called to certain epidemiological observations relating to pellagra which appeared inexplicable on any theory of communicability. These observations showed that, at certain institutions at which pellagra was either epidemic or had long been endemic among the inmates, the nurses

and attendants, drawn from the class economically and socially identical with that most afflicted in the population at large, appeared uniformly to be immune, although living in the same environment and under the same conditions as did the inmates. Neither "contact" nor insect transmission seemed capable of explaining such a phenomenon. It was suggested that the explanation was to be found in a difference, which was believed to exist, in the diet of the two groups of residents.

From a study of the dietaries of certain institutions in which pellagra prevailed the impression has been gained that cereals and vegetables formed a much greater proportion in them than they did in the dietaries of well-to-do people; that is, people who as a class are practically exempt from pellagra. It was suggested, therefore, that it might be well to attempt to prevent the disease by reducing the cereals, vegetables, and canned foods and increasing the fresh animal foods, such as fresh meats, eggs, and milk; in other words, by providing those subject to pellagra with a diet such as that enjoyed by well-to-do people, who as a group are practically free from the disease.

In planning the field studies for 1914 it was proposed, with the approval of the bureau and the department, to put this suggestion to a practical test.

In accordance with the original plan to carry on the test for at least two years, the experiment is still in progress. The results so far recorded are so striking, however, and of such profound practical importance that they are reported at this time.

In planning the test of the preventive value of diet it was decided to take advantage of the universally recognized fact that "normally" pellagra tends to recur in the individual from year to year.

In order to obtain significant and perhaps decisive results, it was decided to submit to the test as large a number of individuals as possible at some institution where the disease was endemic. After some search an orphanage with a high incidence of pellagra among its residents was found at Jackson, Miss.

As a preliminary, a study was made of the epidemiology of the disease at this institution, and the singular fact was very quickly discovered that the disease was practically exclusively confined to those between 6 and 12 years of age. After a detailed inquiry the only explanation that could be found for the remarkable restriction of the disease to this group was a difference in the diet of the resident groups.

In the diet of the affected group, as contrasted with that of the exempt groups, there was noted a disproportionately small amount of lean meat or other animal protein food, so that the vegetable component, in which biscuits (wheat flour), grits, meal (corn), and sirup

were prominent and legumes relatively inconspicuous, formed a disproportionately large part of the ration. Inquiry at other institutions developed analogous conditions, and as a whole the findings, in the light of the recent advances in our knowledge of beriberi, very strongly suggested the idea that the disease was dependent upon a diet that was for some reason faulty and that this fault was in some way either prevented or corrected by including in the diet larger proportions of the fresh animal protein foods. These findings not only confirmed the writer's previous tentative deductions but helped in defining these deductions more clearly, and moreover made it possible more definitely to formulate plans, which were temporarily broadened to include a test of diet in the treatment as well as in the prevention of the disease.

At the suggestion of the writer, Dr. W. F. Lorenz, special expert, United States Public Health Service, who was at that time studying the psychiatric manifestations of pellagra at the Georgia State Sanitarium, treated a series of 27 cases in the insane at that asylum exclusively by diet. Considering the class of cases with which he was dealing, his results, as well as those of Dr. D. G. Willets, who for a time continued the work begun by Lorenz, were notably favorable.

When the various recent methods of treatment, each warmly advocated by its author, are critically reviewed in the light of the test made by Lorenz and by Willets, one can not fail to be struck by the fact that the one thing they all appear to have in common is the so-called "nutritious" diet, and it is difficult to escape the conclusion that it is to this single common factor that the marked success that is usually claimed for the "treatment" should properly be assigned.

It is of much interest to note that fully 50 years ago Roussel (Roussel 1866, pp. 529-530), on the basis of long experience and from a critical review of the literature of his day, came to precisely the same conclusion. This is so much to the point that it is quoted herewith: "Without dietetic measures *all remedies fail*.¹ * * * when drugs and good food are simultaneously employed it is to the latter that the curative action belongs, the former exercises simply an adjuvant action and is without proved efficacy except against secondary changes or accidental complications."

Important as the treatment of the individual case may be, it seemed to the writers of much more fundamental importance to apply their resources to the problem of prevention. Arrangements were therefore made to extend the preventive study to a second orphanage and later to two groups of insane at the Georgia State Sanitarium.

¹ Italics are Roussel's.

ORPHANAGE STUDY.

(By GOLDBERGER and WARING.)

Both the orphanages at which the value of diet in the prevention of pellagra has been tested are located in Jackson, Miss.

The first of these to be considered will be spoken of as orphanage "M. J." Cases of pellagra have been recognized at this institution every spring for several years. During the spring and summer of 1914, up to September 15, 79 cases of the disease were observed in children at this orphanage. Although several of these were known to have had pellagra on admission or had developed it a short time after admission, a number appeared to have developed the disease for the first time after considerable periods of residence at this institution. The factor or factors causing pellagra and favoring its recurrence seemed, therefore, to be operative at this orphanage.

The second of the orphanages, which will be referred to as orphanage "B. J.," is located about half a mile east of orphanage "M. J." Here, as at "M. J.," cases of pellagra have been recognized every spring for several years. The writers are informed by the superintendent that a condition which he can not distinguish from that now called pellagra has occurred every year among the children ever since his connection with the institution, a matter of some 12 to 13 years. From his description it is believed that there can be but little doubt that pellagra has prevailed at this institution almost, if not quite, since its foundation in 1897.

During the spring and summer of 1914, up to September 15, there were observed among the children at this institution 130 cases of pellagra. As at "M. J.," some of these were in recent admissions; a large proportion, however, occurred in long-time residents.

There appears to be little if any reason to doubt that the factor or factors causing the disease and favoring its recurrence have been operative at this institution for many years.

At both institutions the hygienic and sanitary conditions found left much to be desired. Both were much overcrowded.

The drinking water at each is drawn from the public supply.

One is equipped with a water carriage sewerage system connected with that of the city; the other has the unscreened surface privy type of sewage disposal and, incidentally, we found here a great deal of soil pollution.

At the very outset it was requested that no change be made in hygienic and sanitary conditions, and it is believed that these have remained as they were found and as they have been for several years.

Since about the middle of September, 1914, the diet at both orphanages has in certain respects been supplemented by the Public

Health Service. At both institutions a very decided increase was made in the proportion of the fresh animal and of the leguminous protein foods.

The milk supply was greatly increased. Provision was made to give every child under 12 years a cup of about 7 ounces of milk at least twice a day. Those under 6 years had it three times a day. Until the spring of 1915 the milk used was all fresh sweet milk. In April of this year buttermilk was added to the diet. This was served at first only on alternate days to those over 12 years of age; later, when a sufficient supply became available, it was served daily at the midday meal to all.

Eggs, except in cooking or for the sick, had previously not entered into the regular diet of these children. The writers prescribed at least one egg at the morning meal for every child under 12 years of age. It had been the custom to serve the children with fresh meat but once a week; under the writers' direction it was increased to three or four times a week.

Beans and peas, which had been conspicuous in the diet only during the summer and fall, were made an important part of nearly every midday meal at all seasons.

The carbohydrate component of the institution diets was also modified. The breakfast cereal was changed from grits to oatmeal, partly because it was believed to be an advantage to reduce the corn element and in part because it was believed that the oatmeal would favor the increased consumption of milk. The corn element, though much reduced, was not wholly excluded. Corn bread was allowed all children once a week and grits to those over 12 years of age once or twice a week. Cane sirup or molasses, which it had been customary to serve freely at two or three meals each day, was for some weeks entirely excluded, and later allowed in small amounts at only three or four evening meals a week. The object in this was to reduce the proportion of the carbohydrate element. A more detailed idea of the character of the diet furnished may be obtained by reference to the menus herewith submitted.

Orphanage, M. J.—January 1 to 7, 1915.

BREAKFAST.

All ages:

Oatmeal, with sugar and milk, biscuit with butter, daily. Frankfurters (boiled), one morning, in place of fried bacon or eggs.

Matrons and "big" boys:

Fried bacon on six mornings.

All under 12 years:

Milk (about 7 ounces) as a beverage, daily; one egg (scrambled, fried, or boiled), six mornings.

DINNER.

January 1:

All—

Vegetable soup (tomatoes, Irish potatoes,
corn, onions, rice).

Baked sweet potatoes.

Corn bread.

Light bread.

Matrons—

Biscuit.

January 2:

All—

Navy beans (boiled).

Baked sweet potatoes.

Light bread.

Pie (blackberry, peach).

Matrons—

Hot biscuit.

Corn muffins.

January 3:

All—

Roast beef.

Lima beans (boiled).

Layer cake.

Matrons—

Baked sweet potatoes.

Boiled rice custard.

Blackberry preserves.

January 4:

All—

Vegetable soup (tomatoes, rice, onions,
navy beans).

Hash for three tables.

Baked sweet potatoes.

Boiled navy beans.

Light bread.

January 4—Continued.

Matrons—

Corn bread.

Hot biscuit.

January 5:

All—

Vegetable soup, (tomatoes, rice, onions).

Roast beef.

Baked sweet potatoes.

Boiled lima beans.

Light bread.

Matrons—

Biscuits, corn bread.

January 6:

All—

Roast beef.

Boiled navy beans.

Baked sweet potatoes.

Blackberry pie (five tables).

Stewed pears (three tables).

Light bread.

Matrons—

Biscuit.

Corn muffins.

January 7:

All—

Vegetable soup (tomatoes, rice, onions).

Boiled frankfurters.

Boiled lima beans.

Baked sweet potatoes.

Light bread.

Matrons—

Biscuit.

Corn muffins.

N. B.—Children under 6 years of age received about 7 ounces of milk each daily in addition to the above.

SUPPER.

January 1:

All—

Stewed prunes or pumpkin.

Light bread.

Over 12—

Boiled grits.

January 2:

All—

Sirup.

Light bread.

Over 12—

Boiled rice.

Fried bacon.

January 3:

All—

Cakes.

Light bread.

Milk.

January 4:

All—

Stewed apples.

Light bread.

Over 12—

Fried bacon.

Boiled rice.

January 5:

All—

Light bread.

Sirup.

Over 12—

Boiled grits.

Fried fresh pork.

January 6:

All—

Light bread.

Stewed apples.

Over 12—

Beef hash.

Boiled rice.

January 7:

All—

Light bread.

Sirup.

Milk.

Over 12—

Fried bacon.

Boiled rice.

N. B.—All under 12 years received about 7 ounces of milk daily in addition to the bread and stewed fruit or sirup. The matrons and teachers were served with hot biscuits daily in addition to the other articles noted.

Results.

Orphanage "M. J."—Of the 79 cases of pellagra observed at "M. J." during the spring and summer of 1914, not less than 67 completed at least the anniversary date of their attacks under the observation of the writers. Of these not less than 9 have had at least 2 annual attacks. In none of the 67, following the change in diet, has there been observed so far this year any recognizable evidence of a recurrence, nor have the writers been able to detect any evidence justifying a diagnosis of pellagra in any of the nonpellagrins residents, numbering 99 children and adults, who have been continuously under observation for at least one year. In other words, barring recent admissions, there has been no pellagra at this institution this year.

Orphanage "B. J."—Of the 130 cases of pellagra observed in the children at "B. J." during the summer of 1914, not less than 105 have completed at least the anniversary date of last year's attack under the writers' observation. Not less than 14 of these have histories of at least 2 successive annual attacks. In only 1 of these 105 pellagrins, following the above change in diet, has there, so far this year, been recognized evidence justifying the diagnosis of a recurrence.

Of the residents of this orphanage that did not present any definite evidence of pellagra in 1914, 69 have remained continuously under observation for at least a year; none has thus far developed recognizable evidence of the disease this year. Recent admissions aside, there has been but one case of pellagra at this institution this year.

ASYLUM STUDY.

(By GOLDBERGER and WILLETS.)

Through the courtesy and with the very helpful cooperation of the board of trustees, superintendent, clinical director, and staff of the Georgia State Sanitarium, two wards were turned over to the writers for a test of the value of diet in the prevention of pellagra. To this asylum, the largest in the South, there are admitted annually a considerable number of cases of pellagra. Besides this, cases of institutional origin are of frequent occurrence. This asylum must, therefore, be regarded as an endemic focus of the disease.

Of the two wards placed at our disposal one is in the colored and the other in the white female service; the former was organized in October, the latter in December, 1914.

Each ward has a capacity of about 50 beds. To each there were admitted about 40 adult pellagrins who had had attacks at one time or another during 1914. In organizing the wards and selecting our patients the list of female pellagrins that at that time were known to have had attacks in 1914 was practically exhausted. In selecting

the patients only one condition was observed, namely, that the patient should, if possible, be of such a mental type as would give the highest degree of probability of remaining under observation for at least a year. In consequence a very considerable proportion of them were of a much deteriorated, untidy class. There were, nevertheless, unavoidably included several in whom the mental condition improved to such a degree that we felt obliged to permit them to go when a request for their discharge was made. Not all, therefore, of our original patients remained under observation long enough to be included in the present discussion.

Very few of the patients presented active symptoms on admission to the writers' wards, the object so far as this test was concerned being not a study of the treatment of active symptoms but the prevention of recurrences. A very considerable number of the patients, however, presented marked residuals of a recent attack. Many of the colored patients had been dieted by either Dr. Lorenz or Dr. Willets during the acute stage of their attacks in the same ward prior to its organization for the purpose under consideration. A number of the white females had been dieted during the acute stage by Dr. Y. A. Lyttle, of the asylum staff, and formed part of a series reported on by him at the meeting of the Southern Medical Association in November, 1914. The writers are especially indebted to Dr. Lyttle for his courtesy in subordinating his own study and turning these patients over to them.

The diet furnished the inmates of these two wards was prescribed by the writers, and instructions were given to the nurses to give more than ordinary care in supervising the feeding. As at the orphanages, a decided increase was made in the animal and leguminous protein foods. A cup of sweet milk, about 7 ounces, is furnished each patient for breakfast and one of buttermilk at both dinner and supper. About half a pound of fresh beef and 2 to 2½ ounces of dried field peas or dried beans enter into the daily ration. Oatmeal has almost entirely replaced grits as the breakfast cereal; sirup has been entirely excluded. Corn products, though greatly reduced, have not been entirely eliminated.

The menu that follows will serve to give a more detailed idea of the character of the diet furnished.

Weekly menu for Ward 23.

MONDAY.

BREAKFAST.—Grits, sweet milk, sugar, broiled steak, hot rolls, biscuits, coffee.

DINNER.—Roast beef, gravy, peas, potatoes, rice, biscuits, buttermilk.

SUPPER.—Stewed apples, light bread, coffee, buttermilk, sugar.

TUESDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, Hamburg steak, biscuits, hot rolls, coffee.

DINNER.—Beef stew, potatoes, rice, bread, buttermilk.

SUPPER.—Baked beans, light bread, coffee, sugar, buttermilk.

WEDNESDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, beef hash, hot rolls, biscuits, coffee.
 DINNER.—Pea soup, corn bread, gravy, potatoes, rice, bread, buttermilk.
 SUPPER.—Stewed prunes, light bread, coffee, sugar, buttermilk.

THURSDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, fried steak, hot rolls, biscuits, coffee.
 DINNER.—Beef stew, peas, potatoes, rice, bread, buttermilk.
 SUPPER.—Baked beans, bread, coffee, sugar, buttermilk.

FRIDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, broiled beefsteak, hot rolls, biscuits, coffee.
 DINNER.—Pea soup (purée), roast beef, potatoes, rice, bread, buttermilk.
 SUPPER.—Light bread, coffee, sugar, buttermilk, apples, baked beans.

SATURDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, Hamburg steak, hot rolls, biscuits, coffee.
 DINNER.—Beef stew, potatoes, rice, bread, buttermilk.
 SUPPER.—Bread, baked beans, buttermilk, coffee, sugar.

SUNDAY.

BREAKFAST.—Oatmeal, sweet milk, sugar, mackerel, bread, coffee.
 DINNER.—Loaf beef and gravy, peas, potatoes, rice, bread, buttermilk, pudding.
 SUPPER.—Beef hash, bread, sugar, coffee, buttermilk.
 NOTE.—Green vegetables in season at irregular intervals. Milk and eggs, as a special diet, are furnished those patients who may require them.

Aside from the change in diet and the increased watchfulness over the individual feeding enjoined on the nurses and attendants, no change in the habitual routine of the corresponding services was made. The patients were permitted and encouraged to visit the yard and take the air as frequently as their physical condition and the weather permitted.

Results.—Of the pellagrins admitted to the writers' wards at the time of their organization, or shortly thereafter—that is, not later than December 31, 1914—72 (36 colored and 36 white), have remained continuously under observation up to October 1, 1915, or remained at least until after the anniversary date of their last year's attack. Of the 36 colored patients, 8 have histories of at least 2 annual attacks; of the 36 white patients, 10 have histories of at least 2 attacks. None of this group of 72 patients has presented recognizable evidence of a recurrence of pellagra.

Significance.

The significance of the results set forth naturally depends upon the rate of recurrence that may properly have been expected to occur in the groups studied under "normal" conditions; that is, without interference of any kind.

The ideal form of the experiment would have been, of course, to retain for purpose of comparison a control group at each of the institutions. This was impracticable at the orphanages. In estimating the significance of the results of the orphanage study, the writers are therefore obliged to depend on general observations and on experience

at other similar institutions. Satisfactory observations on the rate of recurrence either in children or adults are, so far as the writers are aware, not available in the accessible literature. There are to be found for the most part simply general statements that the disease tends as a rule to recur from year to year. Fortunately, Dr. H. W. Rice, of Columbia, S. C., has very kindly given a copy of his records of the cases of pellagra observed by him in children at an orphanage to which he has been attending physician. These records show that of 31 children who had pellagra in 1912, 18, or 58 per cent, had recurrences in 1913; of the 21 who had it in 1913, 16, or 76 per cent, had it in 1914; and of 75 who had the disease in 1914, 56, or 75 per cent, had it again in 1915. The rate of recurrence in children at this institution seems to have varied, therefore, between 58 per cent and 76 per cent. These very valuable data enable one to form a definite conception of the frequency of recurrence that one might expect from year to year in children at such institutions as those at which the writers have worked.

Taking 50 per cent, a rate somewhat lower than the lowest of the above rates, as being fairly and conservatively representative and applying it to the orphanages at Jackson, it is found that 33 recurrences at "M. J." and 52 at "B. J." might reasonably have been expected this year, whereas, as already stated, there actually was none observed at the former and only one at the latter institution.

Although not specifically so planned, conditions at the Georgia State Sanitarium have been such as to give a control group of pellagrins in both the colored and the white female service. This permits the making of a direct comparison of the results observed in the writers' wards with those in other wards of the corresponding services at this institution.

The control group of colored female pellagrins of 1914 consists of 17 who have remained under observation for a period comparable to that of the group on the special diet. Of these, 9, or 53 per cent, have already presented recurrences.

The control group of white female pellagrins of 1914 consists of 15 individuals. Of these, 6, or 40 per cent, have had recurrences this year. Combined, the two control groups have thus far presented an average of 47 per cent of recurrences. Besides the recurrence rates in these control groups, the rates of recurrence in previous years in these services have been determined from a study of the records. It is found that in the colored female service the average rate for the four years 1911, 1912, 1913, and 1914 has been 52.5 per cent, the rate in different years having varied from 40 to 70 per cent. In the white female service the average recurrence rate for the same period has been 37.5 per cent, the rate having varied between 22 and 48 per cent.

It must be quite evident, therefore, that on the basis of any of the foregoing rates a considerable number of recurrences in the groups of insane pellagrins subsisting on the modified diet might reasonably have been expected. On the basis of the average recurrence rate, 47 per cent, observed this year in the control groups, we might have expected some 34 recurrences, or on the basis of the average rate, 37.5 per cent, for four years, for the white female service, a rate lower than the average for the colored female service, we might have expected some 20 to 27 recurrences. As already stated, however, none has actually been observed.

Viewing the foregoing results as a whole, bearing in mind that three different institutions in two widely separated localities are involved, each institution being an endemic focus of the disease, and bearing in mind, also, that the number of individuals considered is fairly large, it seems to the writers that the conclusion is justified that pellagra recurrences may be prevented and, in view of the conditions of the test, that they may be prevented without the intervention of any other factor than diet.

In this connection the question arises whether the conclusion is justified that the development of pellagra, apart from its recurrence, may be prevented by diet. The character of the answer to the question will depend on the view held as to the nature of the pellagra recurrence.

Among the epidemiologic features of pellagra none is more striking than the tendency for the disease not only to develop in the spring or early summer, but to recur year after year at about the same season. Various explanations of this singular phenomenon have been advanced. According to Sambon (1910, p. 49), "this peculiar periodicity of symptoms can be explained only by the agency of a parasitic organism presenting definite alternating periods of latency and activity." A somewhat similar conception appears to be held by the workers of the Thompson-MacFadden Commission (Siler, Garrison, and MacNeal, 1914c), who distinguish between conditions favorable for the development of the disease, in the first place, and those that permit its subsequent recurrence. Why Sambon and many other observers should consider this periodicity of symptoms as explicable only by the agency of a parasitic organism or of a virus or a toxin presenting definite alternating periods of latency and activity is rather hard to understand when it is recalled that in endemic scurvy¹ and particularly in endemic beriberi, diseases of well-known dietary origin, a strikingly similar periodicity is present. The following description of the clinical course of beriberi taken from Scheube (1903, pp. 199 to 200) well illustrates this point: "After developing the disease"

¹ Lind, 1772, pp. 33, 84, 130, 306.

[beriberi], says Scheube, "the condition of the patient may remain the same for months. Then, especially on the appearance of the cold season, improvement sets in and recovery ensues. The predisposition is not extinguished by recovery from the disease; on the other hand, he who has once had beriberi is apt to be attacked again. The relapses are sometimes milder, sometimes more severe than the initial attack, and are repeated every year for shorter or longer periods, sometimes, 10, 20, or even 30 years. Sometimes the disease remains absent for one or several years, and then appears anew. Occasionally two or even three attacks occur during the course of one year."

In the light of this striking analogy, it would seem entirely permissible to invoke as an explanation of the periodic recurrence in pellagra, what undoubtedly is the explanation of the same phenomenon in beriberi, namely, a modification or change in diet brought about by or incidental to the recurring seasons.¹ In accordance with this explanation the recurrence in pellagra is to be considered as in beriberi, etiologically, at least, essentially identical with the initial attack; it would seem permissible to conclude, therefore, that the means found effective in the prevention of recurrences will be found effective in the prevention of the initial attack.

From the foregoing it will be observed that the writers' results are at variance with those of some other recent workers in this field, notably, the Thompson-MacFadden Pellagra Commission. In a summary of their second progress report (Siler, Garrison, and MacNeal, 1914b, p. 1093) this commission concludes that its efforts to discover the essential pellagra-producing food or the essential pellagra-preventing food have not been crowned with success, and that their evidence suggests that neither exists in the population studied by them.

In the opinion of the writers this conclusion is due to the way in which they analyzed what is undoubtedly a very valuable mass of data. They assume that the relation of a particular food to pellagra can be determined by comparing the incidence of the disease in groups of families using this particular food with different degrees of frequency. This assumption, however, fails to take into account the possibility that more than one food having a relation to the disease may have been present in the dietaries of the families studied.

Thus it seemed to them, and at first thought it no doubt would seem to others, that if meat, for instance, had any relation to pellagra, this would be revealed by a comparison of the incidence of the disease in a group of families using this food daily with the incidence in a group using it rarely. As a matter of fact, however, although a comparison of the incidence of pellagra in different families grouped on the basis of the frequency of the use of fresh meat might result,

¹ Vedder, 1913, p. 29.

let us say, in finding a greater relative incidence in families using it daily than in those using it rarely, it would not on that account be permissible to conclude that meat had no preventive value, for it may very well be that the families using meat rarely were protected by some other food or foods, such as milk, eggs, or peas, of which they may have been abundant consumers.

In fact, it is believed by the writers that an analysis of the commission's data from this point of view will show, for instance, that there does exist, or may exist, in a group of cotton-mill villages an inverse proportional relation between degree of pellagra morbidity and the percentage of families using fresh meat and milk "daily" and "habitually." In other words, the disagreement in our results from those of the commission is more apparent than real.

It is beside the present purpose to enter into a discussion of the etiology of pellagra. In order that the position of the writers may be clear, however, it is pointed out that they are not to be understood as meaning that pellagra is necessarily due to a lack or deficiency of fresh animal or leguminous protein food. All that they wish to say at present is that the dietary "fault" upon which in their judgment the development of pellagra essentially depends is capable of being corrected or prevented by including in the diet a suitable proportion of these foods. Nor are they to be understood as meaning that the pellagra-causing "fault" is capable of correction or prevention in this way only. The possibility is not excluded that there may be other foods capable of serving the same purpose. Indeed, there is some reason to justify at least a suspicion that barley, rye, and millet may have this power in some degree.

Moreover, it may be, if Funk's suggestion that pellagra is a vitamin deficiency, brought about by the consumption of overmilled corn, is proven to be correct, that the use of undermilled corn will of itself correct the "fault" in a diet in which this cereal is the staple. For the present at least the point of chief, of fundamental, practical importance is the recognition of the fact that the pellagra-producing dietary "fault," whatever its essential nature or however brought about, is capable of correction or prevention, as the results above presented seem to clearly indicate, by including in the diet suitable proportions of the fresh animal and leguminous foods.

Summary and Conclusion.

1. The diet at two orphanages, "M. J." and "B. J.," for several years endemic foci of pellagra, was modified in accordance with the directions of the writers in September, 1914. Hygienic and sanitary conditions have remained unchanged.
2. The modification in the diet consisted principally of a marked increase in the fresh animal and the leguminous protein foods.

3. Since the change in diet at orphanage "M. J." there has not been observed any recognizable evidence of a recurrence in any of the pellagrins of 1914, 67 of whom remained under observation until they had completed at least the anniversary date of their attacks. Nor have any new cases been observed among the nonpellagrin residents of 1914, 99 of whom have been under observation for not less than a year.

4. Since the change in diet at orphanage "B. J." there has been observed this year but a single individual with recognizable evidence of a recurrence among the pellagrins of 1914, 105 of whom remained under observation until they had completed at least the anniversary date of their attacks. Nor has any new case been observed among the nonpellagrin residents, 69 of whom have been under observation not less than a year.

5. At the Georgia State Sanitarium, an endemic focus of pellagra, a ward of pellagrins in the colored female service and one in the white female service was organized in October and December, 1914, respectively, for a test of diet in the prevention of pellagra.

6. The diet in these wards was modified on the same principle as that at the orphanages. The institution routine and the hygienic and sanitary conditions have remained unchanged.

7. Since the change of diet and up to October 1, 1915, there has not been observed this year any recognizable evidence of a recurrence in any of the pellagrins in these wards, 72 of whom (36 colored and 36 white females) have remained continuously under observation throughout this period or at least until the completion of the anniversary date of their 1914 attacks.

8. During the corresponding period of observation not less than 15 (47 per cent) of 32 control female pellagrins have presented recurrences.

9. The conclusion is drawn that pellagra may be prevented by an appropriate diet without any alteration in the environment, hygienic or sanitary.

APPLICATION.

(By GOLDBERGER.)

The practical application of the foregoing to the problem of the prevention and eradication of pellagra seems so obvious that extended discussion is not called for in the present communication, particularly as a somewhat detailed outline of treatment and prevention has already been published (Goldberger, Willets, and Waring, 1914a and 1914b). At this time it is desired simply to submit for consideration some general recommendations that appear to be pertinent to the problem.

In order that a suitable modification in the diet of the population chiefly affected may be brought about the writer would recommend:

1. An increase in the diet of fresh animal and leguminous foods, particularly during the late winter and spring.
 - a. Ownership of a milk cow and increase in milk production for home consumption.
 - b. Poultry and egg raising for home consumption.
 - c. Stock raising.
 - d. Diversification and the cultivation of food crops (including an adequate pea patch) in order to minimize the disastrous economic effects of a crop failure and to make food cheaper and more readily available.
 - e. Making these foods as accessible as possible in the more or less isolated industrial communities by providing markets, particularly butcher shops, throughout the year.
2. A reduction in the diet of the carbohydrate (starchy) foods.
 - a. Improve economic conditions; increase wages, reduce unemployment.
 - b. Make the other class of foods cheap and readily accessible.

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